**Flow and heat transfer in an asymmetric trapezoidal duct with turbulators**

***Nasser Abdoul Halim ISMAEL1, [C:\Users\Abdullah\AppData\Local\Microsoft\Windows\INetCache\Content.Word\ORCID-iD_icon-16x16.gif](https://orcid.org/xxxx-xxxx-xxxx-xxxx), SelmaAKÇAY2[[1]](#footnote-1)\*[C:\Users\Abdullah\AppData\Local\Microsoft\Windows\INetCache\Content.Word\ORCID-iD_icon-16x16.gif](https://orcid.org/0000-0003-2654-0702), Maher Abdulhameed Sadeq SADEQ3[C:\Users\Abdullah\AppData\Local\Microsoft\Windows\INetCache\Content.Word\ORCID-iD_icon-16x16.gif](https://orcid.org/xxxx-xxxx-xxxx-xxxx)***

*1* **0009-0003-4779-0847**, *Undergraduate Student of Mechanical Engineering, Çankırı Karatekin University, Çankırı, Türkiye2*

*2\** **0000-0003-2654-0702**, *Çankırı Karatekin University, Engineering Faculty, Department of Mechanical Engineering, Çankırı, Türkiye*

*3* **xxxx-xxxx-xxxx-xxxx**, *Undergraduate Student of Mechanical Engineering, Çankırı Karatekin University, Çankırı, Türkiye*

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| **Abstract**  Channels with wavy/corrugated surfaces, which are passive heat transfer improvement methods, have attracted great attention for a long time [1,2]. Corrugated channels provide significant improvement in heat transfer because they increase surface area [3]. Another passive method is the turbulators/obstacles added to channel [4]. The purpose of these turbulators is to direct the flow in a certain direction, improve flow mixing and increase heat transfer [5]. To date, heat transfer in wavy channels with different geometries with or without turbulators has been investigated by many numerical and experimental studies and as a result, it has been reported that significant improvements in heat transfer are obtained in these channels compared to straight channels [6-8]. In this study, a trapezoidal duct with asymmetric geometry was used and circular turbulators were placed inside the wavy channel. The heat transfer behavior of circular turbulators in three different diameters was investigated. The analyses were performed with the finite volume method and the standard k-ε turbulence model was used as the viscous model. The wavy surfaces of the channel were kept constant at Tw=340 K and the channel outlet temperature (Tout), convection heat transfer coefficient (h), Nusselt number (Nu) and heat transfer improvement rate (ER) were found at different Reynolds numbers (3000≤Re≤6000). The results were presented as graphs. The velocity and temperature images were obtained for different parameters in the channel and the results were discussed. In addition, the results were compared with the wavy channel without turbulators. As a result of the study, it was observed that heat transfer improved by increasing inlet velocity. It was seen that the circular turbulators added to the channel significantly affected the heat transfer and the heat transfer increased with the increase in the circular turbulator diameters.    **References:**  [1] Zhang, J., Zhu, X., Mondejar, M. E., & Haglind, F. (2019). A review of heat transfer enhancement techniques in plate heat exchangers. *Renewable and Sustainable Energy Reviews*, 101, 305-328.  [2] Nitturi, L. K., Kapu, V. K. S., Gugulothu, R., Kaleru, A., Vuyyuri, V., & Farid, A. (2023). Augmentation of heat transfer through passive techniques. *Heat Transfer,* https://doi.org/10.1002/htj.22877  [3] Alfellag, M.A., Ahmed, H.E., Jehad, M.G., & Farhan, A.A. (2022). The hydrothermal performance enhancement techniques of corrugated channels: A review. *Journal of Thermal Analysis and Calorimetry*, 147, 10177-10206.  [4] Alam, T., & Kim, M. H. (2018). A comprehensive review on single phase heat transfer enhancement techniques in heat exchanger applications. *Renewable and Sustainable Energy Reviews*, 81, 813-839.  [5] Akcay, S. (2023). Numerical study of turbulent heat transfer process in different wavy channels with solid and perforated baffles, *Heat Transfer Research*, 54(18), 53-82.  [6] Uysal, D., & Akçay, S. (2024). Numerical study of thermal and hydrodynamic characteristics of turbulent flow in hybrid corrugated channels with different wave profiles. *Journal of Mechanical Engineering and Sciences*, 18(2), 10026–10045  [7] Zheng, Y., Yang, H., Mazaheri, H., Aghaei, A., Mokhtari, N., & Afrand, M. (2021). An investigation on the influence of the shape of the vortex generator on fluid flow and turbulent heat transfer of hybrid nanofluid in a channel. *Journal Thermal Analysis and Calorimetry,* 143,1425–1438.  [8] Brodniansk´a, Z., & Kotˇsmíd, S. (2023). Heat transfer enhancement in the novel wavy shaped heat exchanger channel with cylindrical vortex generators. *Applied Thermal Engineering*, 220, 119720 |

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1. \* Corresponding author. *e-mail address: selmaakcay@karatekin.edu.tr* [↑](#footnote-ref-1)